

COMANDO DA AERONÁUTICA
CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE
ACIDENTES AERONÁUTICOS



FINAL REPORT
A-021/CENIPA/2021

| | |
|--------------------|------------------|
| OCCURRENCE: | ACCIDENT |
| AIRCRAFT: | PT-WVZ |
| MODEL: | AT-402A |
| DATE: | 06FEV2021 |



NOTICE

According to the Law n  7565, dated 19 December 1986, the Aeronautical Accident Investigation and Prevention System – SIPAER – is responsible for the planning, guidance, coordination, and execution of the activities of investigation and prevention of aeronautical accidents.

The elaboration of this Final Report was conducted considering the contributing factors and hypotheses raised. The report is, therefore, a technical document which reflects the result obtained by SIPAER regarding the circumstances that contributed or may have contributed to triggering this occurrence.

The document does not focus on quantifying the degree of contribution of the distinct factors, including the individual, psychosocial or organizational variables that conditioned the human performance and interacted to create a scenario favorable to the accident.

The exclusive objective of this work is to recommend the study and the adoption of provisions of preventative nature, and the decision as to whether they should be applied belongs to the President, Director, Chief or the one corresponding to the highest level in the hierarchy of the organization to which they are being forwarded.

This Final Report has been made available to the ANAC and the DECEA so that the technical-scientific analyses of this investigation can be used as a source of data and information, aiming at identifying hazards and assessing risks, as set forth in the Brazilian Program for Civil Aviation Operational Safety (PSO-BR).

This Report does not resort to any proof production procedure for the determination of civil or criminal liability, and is in accordance with Appendix 2, Annex 13 to the 1944 Chicago Convention, which was incorporated in the Brazilian legal system by virtue of the Decree n  21713, dated 27 August 1946.

Thus, it is worth highlighting the importance of protecting the persons who provide information regarding an aeronautical accident. The utilization of this report for punitive purposes maculates the principle of “non-self-incrimination” derived from the “right to remain silent” sheltered by the Federal Constitution.

Consequently, the use of this report for any purpose other than that of preventing future accidents, may induce to erroneous interpretations and conclusions.

N.B.: This English version of the report has been written and published by the CENIPA with the intention of making it easier to be read by English speaking people. Considering the nuances of a foreign language, no matter how accurate this translation may be, readers are advised that the original Portuguese version is the work of reference.

SYNOPSIS

This is the Final Report of the 06 February 2021 accident with the AT-402A aircraft, registration marks PT-WVZ. The occurrence received the typification of “[RE] Runway Excursion”.

During the takeoff run, the aircraft failed to reach the rotation speed, overrunning the departure end of the airstrip for aeroagricultural use. The aircraft overturned and caught fire after its right-hand wing collided with the ground.

The aircraft was destroyed.

The pilot suffered minor injuries.

Being Canada the State of design and manufacture of the aircraft’s engine, the Canadian TSB (Transportation Safety Board) appointed an Accredited Representative for participation in the investigation of the occurrence.



TABLE OF CONTENTS

| | |
|--|-----------|
| GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS | 5 |
| 1. FACTUAL INFORMATION..... | 6 |
| 1.1. History of the flight..... | 6 |
| 1.2. Injuries to persons..... | 6 |
| 1.3. Damage to the aircraft..... | 6 |
| 1.4. Other damage..... | 6 |
| 1.5. Personnel information..... | 7 |
| 1.5.1. Crew's flight experience..... | 7 |
| 1.5.2. Personnel training..... | 7 |
| 1.5.3. Category of licenses and validity of certificates..... | 7 |
| 1.5.4. Qualification and flight experience..... | 7 |
| 1.5.5. Validity of medical certificate..... | 7 |
| 1.6. Aircraft information..... | 7 |
| 1.7. Meteorological information..... | 8 |
| 1.8. Aids to navigation..... | 8 |
| 1.9. Communications..... | 8 |
| 1.10. Aerodrome information..... | 8 |
| 1.11. Flight recorders..... | 9 |
| 1.12. Wreckage and impact information..... | 9 |
| 1.13. Medical and pathological information..... | 10 |
| 1.13.1. Medical aspects..... | 10 |
| 1.13.2. Ergonomic information..... | 10 |
| 1.13.3. Psychological aspects..... | 10 |
| 1.14. Fire..... | 10 |
| 1.15. Survival aspects..... | 10 |
| 1.16. Tests and research..... | 10 |
| 1.17. Organizational and management information..... | 10 |
| 1.18. Operational information..... | 11 |
| 1.19. Additional information..... | 15 |
| 1.20. Useful or effective investigation techniques..... | 15 |
| 2. ANALYSIS..... | 15 |
| 3. CONCLUSIONS..... | 16 |
| 3.1. Findings..... | 16 |
| 3.2. Contributing factors..... | 17 |
| 4. SAFETY RECOMMENDATIONS | 18 |
| 5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN..... | 18 |

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

| | |
|----------|---|
| AFM | Airplane Flight Manual |
| ANAC | Brazil's National Civil Aviation Agency |
| CIV | Pilot Logbook |
| CMA | Aeronautical Medical Certificate |
| COA | Agricultural Aircraft Operator Certificate |
| CVA | Airworthiness-Verification Certificate |
| GRSO | Safety Risk Management |
| GSO | Gestor da Segurança de Voo |
| IS | Supplementary Instruction |
| MGSO | Safety Management Manual |
| MNTE | Single-Engine Land Airplane Class Rating |
| MTOW | Maximum Takeoff Weight |
| OM | Maintenance Organization |
| PAGA | Agricultural Pilot Rating (Airplane) |
| PIC | Pilot in Command |
| PCM | Commercial Pilot License (Airplane) |
| RBAC | Brazilian Civil Aviation Regulation |
| ROTAER | Air Routes Auxiliary Manual |
| SACI | Integrated Civil Aviation Information System |
| SAE-AG | Specialized Public Air Service Registration Category - Aeroagricultural |
| SSAK | ICAO location designator - <i>Carlos Ruhl</i> Aerodrome, <i>Cruz Alta</i> , State of <i>Rio Grande do Sul</i> |
| SERIPA V | 5th Regional Service for the Investigation and Prevention of Aeronautical Accidents |
| SIPAER | Aeronautical Accidents Investigation and Prevention System |
| SN | Serial Number |
| TBO | Time Between Overhauls |
| TSB | <i>Canada's Transportation Safety Board</i> |
| UTC | Coordinated Universal Time |

1. FACTUAL INFORMATION.

| | | |
|-------------------|---|--|
| Aircraft | Model: AT-402A Registration: PT-WVZ Manufacturer: Air Tractor. | Operator: <i>Destaque Aviação Agrícola Ltda. - ME.</i> |
| Occurrence | Date/time: 06FEV2021 - 19:45 UTC Location: <i>Fazenda José Mezza.</i> Lat. 28°58'34"S Long. 053°19'04"W Municipality – State: <i>Fortaleza dos Valos – Rio Grande do Sul.</i> | Type(s): [RE] Runway excursion |

1.1. History of the flight.

At around 19:45 UTC, the aircraft was to take off from the airstrip for aero-agricultural use of *Fazenda José Mezza* in the municipality of *Fortaleza dos Valos*, State of *Rio Grande do Sul*, engaged on a local aerial application flight, with 01 POB (pilot).

During the takeoff run, the aircraft did not reach the rotation speed, and overran the departure end of the airstrip. The airplane's right-hand wing collided with the ground, causing the aircraft to flip and catch fire.



Figure 1 - View of the PT-WVZ at the crash site.

The aircraft was destroyed by the fire, and the pilot suffered minor injuries.

1.2. Injuries to persons.

| Injuries | Crew | Passengers | Others |
|----------|------|------------|--------|
| Fatal | - | - | - |
| Serious | - | - | - |
| Minor | 1 | - | - |
| None | - | - | - |

1.3. Damage to the aircraft.

The aircraft was destroyed.

1.4. Other damage.

NIL.

1.5. Personnel information.

1.5.1. Crew's flight experience.

| Flight Experience | |
|-----------------------------------|---------|
| | PIC |
| Total | Unknown |
| Total in the last 30 days | Unknown |
| Total in the last 24 hours | Unknown |
| In this type of aircraft | 04:20 |
| In this type in the last 30 days | 04:20 |
| In this type in the last 24 hours | 00:20 |

N.B.: The aircraft logbook contained information that the PIC had approximately 4 hours and 20 minutes of flight in the PT-WVZ.

Reports indicated that the PIC had flown approximately 10,000 hours in Ipanema aircraft (EMB-201), and that he had left the board of pilots of the referred aircraft to operate the AT-402A, in which he would have allegedly performed around 30 hours of flight before the accident.

However, in accordance with data collected from his Digital CIV of the ANAC's SACI System (Integrated Civil Aviation Information System), on the date of the accident, the PIC had a total of approximately 5 hours and 42 minutes of flight.

According to reports, the PIC had experience in that type of flight. Nonetheless, formal records were not presented to confirm such experience.

1.5.2. Personnel training.

The pilot did his PAGA course (Agricultural Pilot – Airplane) in 1984, at the *Aeroclube de Itápolis*, State of *São Paulo*.

1.5.3. Category of licenses and validity of certificates.

The PIC held a PCM license (Commercial Pilot – Airplane), as well as valid MNTE (Single-Engine Land Airplane) and PAGA (Agricultural Pilot - Airplane) ratings.

1.5.4. Qualification and flight experience.

The PIC had qualification and experience relatively to the type of flight.

1.5.5. Validity of medical certificate.

The PIC held a valid CMA (Aeronautical Medical Certificate).

1.6. Aircraft information.

The Serial Number 402A1070 aircraft was a product manufactured by Air Tractor in 1998. The airplane was registered in the Specialized Air Services Registration Category - Aeroagricultural (SAE-AG).

The aircraft's CVA (Airworthiness-Verification Certificate) was valid.

Taking into consideration the recommendations provided in the ANAC's Supplementary Instruction (IS) nº 43.9-003B, the airframe, engine, and propeller logbooks were out of date, as there was a lack of records in the said documents.

The company operating the aircraft presented only the Part I of the airframe logbook, and stated that there was nothing in the other parts. However, in the engine and airframe logbooks, there were two transcripts of removal and installation of the propeller, performed, respectively, on 07 February 2015 and 05 June 2020.

The last inspections of the aircraft and engine, (type “100 hours”) took place on 21 January 2021, on the premises of the *DPA - Aviação Agrícola Ltda* Maintenance Organization (OM) in *Cachoeira do Sul*, State of *Rio Grande do Sul*. The aircraft flew 5 hours and 20 minutes after the inspections.

According to the documentation presented, the SN PCE-RH0033 PT6A-11AG engine, which equipped the PT-WVZ, had 3,088 hours and 55 minutes of flight time, an indication that the component had operated 88 hours and 55 minutes beyond the Time between Overhauls (TBO) which, in consonance with the maintenance manual, was 3,000 hours.

The PIC did not report a possible contribution of any of the aircraft systems to the occurrence.

1.7. Meteorological information.

The PIC said that the meteorological conditions were consistent with the type of flight, being the temperature around 29°C, wind direction approximately 060° at 4 kt., devoid of cloud covers and without visibility restrictions, as shown in Figure 2.



Figure 2 - Image of the crash site moments after the occurrence.

1.8. Aids to navigation.

NIL.

1.9. Communications.

NIL.

1.10. Aerodrome information.

The accident happened in an airstrip for aeroagricultural use, whose surface was grassy, with thresholds 13/31, dimensions of 700 m x 16 m, at an elevation of 1,322 ft at the thresholds, and 1,360 ft in the middle of the airstrip, indicating a positive slope with a variation of 36 ft (11 m) between the thresholds and the highest point on the airstrip (Figure 3).



Figure 3 - View of the airstrip for aeroagricultural use from the threshold 13.

The operating company was requested to present the SRM (Safety Risk Management) for the landing area, but presented the SMM (Safety Management Manual) instead.

1.11. Flight recorders.

Neither required nor installed.

1.12. Wreckage and impact information.

The impact occurred beyond the departure end of the airstrip, without any signs of previous collision. The distribution of the debris was concentrated.

The collision was witnessed by the loading assistant, who happened to be nearby.

The first impact occurred when the right-hand wing hit the ground, causing the aircraft to roll and flip, as shown in Figure 4.



Figure 4 - Location of the runway excursion and point of impact with the ground.

The aircraft caught fire after coming to a stop. The high degree of destruction and charring of the aircraft made it difficult to check both the equipment and the instruments (Figure 5).



Figure 5 - View of the PT-WVZ destroyed by fire.

1.13. Medical and pathological information.

1.13.1. Medical aspects.

No evidence was found that issues of physiological nature or incapacitation might have affected the pilot's performance.

1.13.2. Ergonomic information.

NIL.

1.13.3. Psychological aspects.

No evidence was found that issues of psychological nature might have affected the pilot's performance.

1.14. Fire.

According to the pilot, the fire started after the impact with the ground. Since the aircraft had been fueled for the start of the aerial application, there was a significant amount of fuel in the tanks, contributing to the persistence of the flames and the charring of the aircraft.

There were no fire-fighting procedures available in the landing area for aeroagricultural use.

1.15. Survival aspects.

The pilot was rescued by the team assistant, who was nearby and provided first aid besides sending him for medical assistance.

1.16. Tests and research.

NIL.

1.17. Organizational and management information.

The company's SMS, in its item 1.3, "Conditions for Operations at *Destaque Aviação Agrícola Ltda.*", read that, before each operation, the Flight Safety Manager (GSO) should evaluate the area of operation. It also defined that the GSO should prepare and publicize an Operational Safety Risk Management (SRM) to all company employees. However, neither the evaluation nor the documentation concerning the area of operation was presented.

The Subpart D, "Landing Area for Aeroagricultural Use and Aeroagricultural Operations at Aerodromes", of the Brazilian Civil Aviation Regulation nº 137 (RBAC-137),

“Certification and Operational Requirements: Aeroagricultural Operations”, in force on the date of the accident, established in its Section 137.301 - Landing Area for Aeroagricultural Use that:

- (a) The construction and/or provision of a landing area for aeroagricultural use is the sole responsibility of the owner of the area.
- (b) The COA holder must perform a GRSO (SRM) prior to the start of operations at each location. (emphasis added)
- (c) The COA holder must prepare and keep the SRM analysis at the operational headquarters. (emphasis added)
- (d) The landing area for aeroagricultural use does not need to be registered before the ANAC.
- (e) No one is allowed to operate an aircraft in a landing area for aeroagricultural use, unless:
 - (1) the operation is exclusive to aeroagricultural activities during a previously defined period;
 - (2) the owner of the area has agreed to its construction and use;
 - (3) the agricultural aircraft does not carry passengers;
 - (4) the area to be used meets the requirements for safe operation of the agricultural aircraft at its maximum performance, in accordance with the respective flight manual; and
 - (5) the use of the selected area is not prohibited by any legal or regulatory provisions.
- (f) The use of a landing area for aeroagricultural use is the sole responsibility of the aeroagricultural operator.
- (g) Nighttime agricultural operations are prohibited in a landing area for aeroagricultural use.
- (h) The aeroagricultural operator must comply with the rules established by the DECEA.

1.18. Operational information.

The aircraft was above the weight and balance limits specified by the manufacturer.

According to PIC’s reports, he had operated Ipanema aircraft (EMB-201) for many years within the company, and was selected to join the crew of the Air Tractor aircraft (AT-402A), having flown around 30 hours in the latter model of aircraft before the accident.

The PIC did not do the AT-402A course taught by the manufacturer. Instead, he underwent adaptation and some training, operating from the company's home base, located at SSAK (*Carlos Ruhl Aerodrome, Cruz Alta, State of Rio Grande do Sul*).

Although measurements made by the Investigation Commission indicated that the runway 08/26 of *Carlos Ruhl Aerodrome* had a length of approximately 1,200 m, the ROTAER (Auxiliary Air Route Manual) listed the following declared distances for the respective SSAK runways (Figure 6).

| RWY | TORA(m) | TODA(m) | ASDA(m) | LDA(m) |
|-----|---------|---------|---------|--------|
| 08 | 800 | 800 | 800 | 800 |
| 26 | 800 | 800 | 800 | 800 |
| 17 | 650 | 650 | 650 | 650 |
| 35 | 650 | 650 | 650 | 650 |

Figure 6 - Declared distances of SSAK runways.

In accordance with the ROTAER, the grass runways of the aforementioned aerodrome had the following dimensions:

- 08/26 (800 m x 42 m)
- 17/35 (650 m x 46 m)

As for the instruction itself, only the prescribed “class aircraft” models required specific endorsement, in accordance with Supplementary Instruction (SI) nº 61-006 - “Procedures for the Entry of Endorsements in Pilot Flight Records”, in force at the time of the accident. For those aircraft, both training and the respective registration of the endorsement in the aforementioned SI were required before the start of the effective operation. The AT-402A model was not included in the table of the SI in question.

On the manufacturer's website, the Air Tractor Pilot Training Course - Series 402, 502, 504, 602 was available, and had the following sections: 1 - Aircraft Systems; 2 - Normal Operations; 3 - Emergency Procedures; and 4 - Operating Limitations/Performance.

This course had the objective of providing basic understanding of the Air Tractor systems; familiarizing pilots with normal and emergency aircraft procedures; and, explaining the performance limitations of each aircraft model.

The manufacturer also highlighted that the course was intended to serve as a training tool, and should be considered in conjunction with the Air Tractor Flight Manuals.

In total, only four flights were recorded to adapt the aircraft, all of them departing from SSAK, located at a distance of approximately 24 NM away from the accident site.

The last record in the aircraft logbook was the ferry flight carried out on the day of the accident (Figure 7).

| Data | DEP | ARR | Partida | Tempo de Voo | Pousos | Combustível |
|-----------|------|------|---------|--------------|--------|-------------|
| 25JAN2021 | SSAK | SSAK | 09:30 | 1,0 | 6 | 500 |
| 26JAN2021 | SSAK | SSAK | 14:30 | 1,0 | 5 | 450 |
| 27JAN2021 | SSAK | SSAK | 17:00 | 1,0 | 7 | 400 |
| 28JAN2021 | SSAK | SSAK | 14:00 | 1,0 | 5 | 500 |
| 06FEV2021 | SSAK | ZZZZ | 15:30 | 0,3 | 1 | 400 |

Table 1 - Data extracted from the PT-WVZ's aircraft logbook.

According to reports, the pilot had flown for around 6 hours on the day of the accident with takeoffs from SSAK and, at around 15:30 UTC, he made an uneventful ferry flight of the aircraft to Fazenda José Mezza, in order to perform his first operation with the AT-402A from an airstrip for agroagricultural use. It should be noted that the referred hours were not registered in the aircraft logbook.

The PIC reported having landed normally on the agricultural airstrip. For the takeoff, he aligned the aircraft with the runway, adjusted flaps to 10°, worked the prescribed checks, and started an arrested takeoff, accelerating up to 1,000 ft.lb. Releasing the brakes, he accelerated to about 1,300 ft.lb. Close to the departure end of the airstrip, the airplane was still at a speed of approximately 60 kt.

In accordance with Section 2 - Normal Procedures of the AT402A Airplane Flight Manual, the expected configuration for takeoff in a fully loaded hopper condition on a short runway was as follows (Figure 7):

TAKEOFF (FULL HOPPER LOAD AND SHORT FIELD):

Use the same procedure as for normal take-off except as follows:

1. Lower flaps to 10° position (First Mark).
2. With a full hopper load full power can be applied (Within torque and temperature limits) before brakes are released.
3. After breaking ground do not retract the flaps until at least 105 mph (91 knots) (IAS) is reached.

Figure 7 - Takeoff (Full hopper load and short field).

Thus, the second item of the takeoff procedure recommended that the engine could be accelerated up to maximum takeoff torque before release of the brakes, as long as the torque and temperature limits were respected.

Relatively to the stall speed, the Section 4 - Performance and Limitations, of the Air Tractor Pilot Training Course-Series 402, 502, 504, 602 highlighted that such speed would be 63 kt with flaps retracted and 55 kt with flaps lowered, for a weight of 3,175 kg (Figure 8).

| PERFORMANCE & LIMITATIONS | | Stall Speeds | | | | |
|--------------------------------------|----|--|----|----|-----|----|
| 402 | | Stall Speeds at 7,000 lbs. (3175 kg) gross weight, power idle: | | | | |
| ANGLE OF BANK (Degrees) | | 0 | 15 | 30 | 45 | 60 |
| Stall Speed (MPH – CAS) Flaps Up | 73 | 74 | 78 | 87 | 103 | |
| Stall Speed (KNOTS – CAS) Flaps Up | 63 | 64 | 68 | 75 | 89 | |
| Stall Speed (MPH – CAS) Flaps Down | 63 | 64 | 68 | 76 | 89 | |
| Stall Speed (KNOTS – CAS) Flaps Down | 55 | 56 | 59 | 65 | 77 | |

Figure 8 - Stall speed of the 402 Series.

The pilot stated that, upon realizing the imminent runway excursion, he applied more flap and pulled the control stick, with the intention of taking the plane off the ground, at which point the aircraft floated for a few meters, and its right-hand wing collided with the ground, causing the aircraft to yaw and flip.

The pilot stated that, after the impact, part of the product that was in the hopper was thrown into his face, and he left the aircraft without turning off the equipment and the instruments. After the accident, he was taken by the support team to the operations base to receive first aid.

According to information collected during the initial action by the investigation team, the aircraft was operating with a weight of approximately 3,505 kg (7,727 lb.), that is, 330 kg above the maximum weight limit prescribed for the AT-402A (3,175 kg /7,000 lb.).

In accordance with Section 4 - Performance, CHART A, contained in the AT-402A AFM, for a weight of 3,505 kg (7,727 lb.), the indicated speed for takeoff would be around 68 kt, whereas, for the maximum takeoff weight within the limits established, the speed would be around 65 kt (Figure 9).

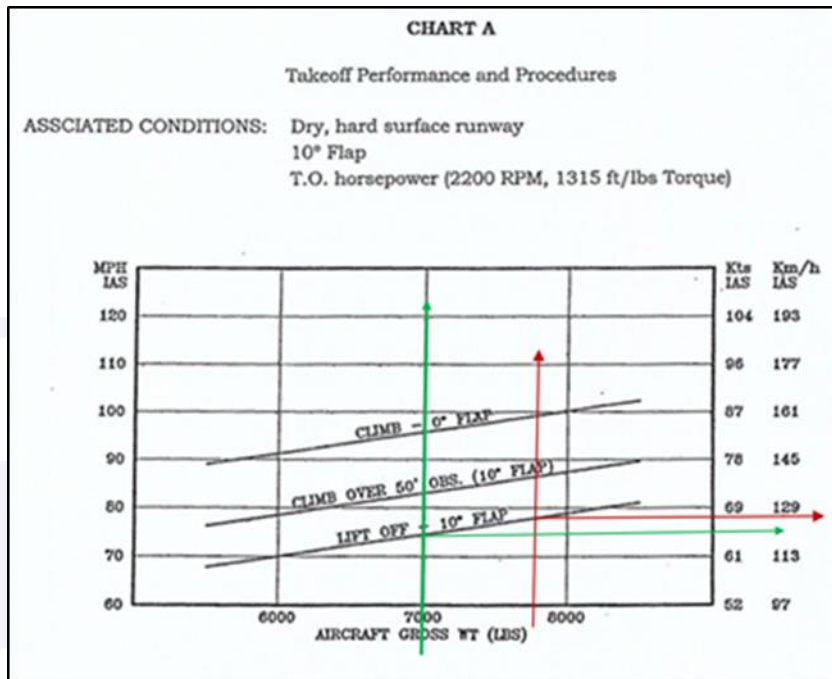


Figure 9 - AT-402A takeoff performance diagram.

Together with the performance diagram in Figure 9, the AFM presented a note informing that the takeoff roll and acceleration during takeoff would be impaired with the aircraft operating from a grassy or soft runway surface:

Takeoff roll and acceleration will be adversely affected by grassy or soft runway surface.

In turn, the takeoff distance required to clear an obstacle at 50 ft, for a weight of 3,175 kg (7,000 lb.), at an altitude of 1,360 ft, with a temperature of 24.3°C, with maximum takeoff power, from a hard dry surface, would be approximately 900 m. (Figure 10).

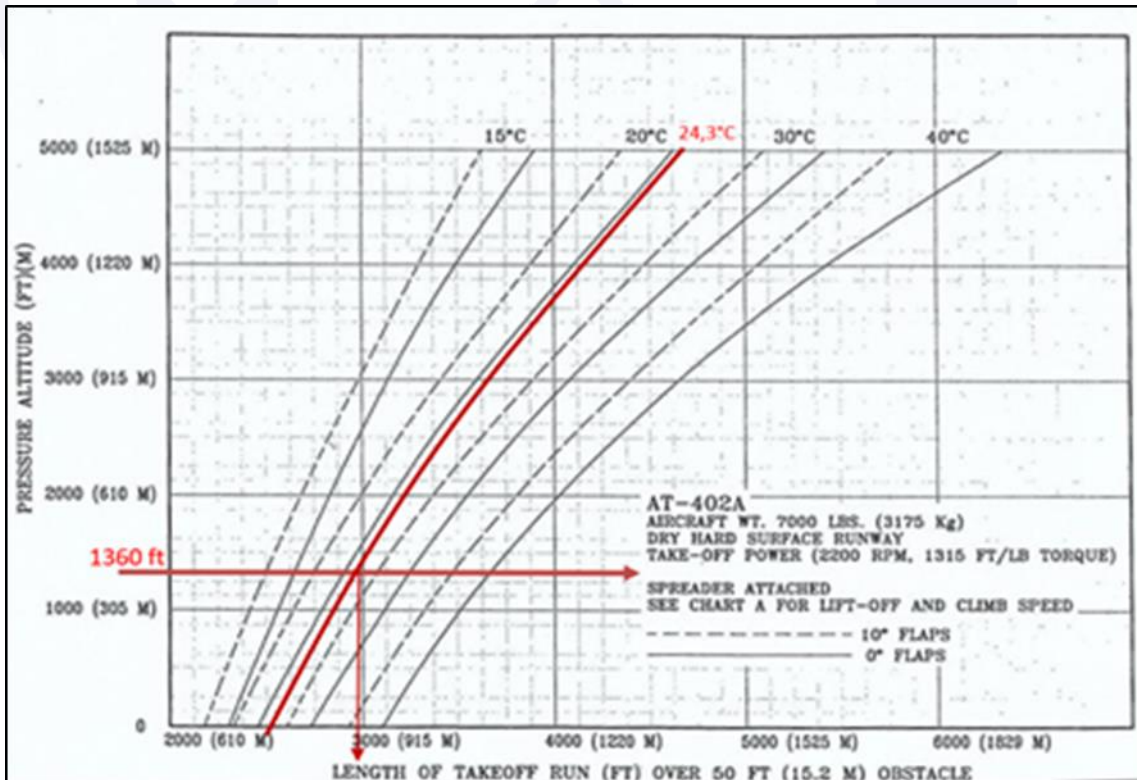


Figure 10 – Takeoff-distance diagram for a weight of 3,175 kg.

In accordance with the flight manual, before takeoff and with a loaded hopper, the position of the trim should be slightly behind the green range of normal operation. However, the pilot was unable to inform the exact position of the trim during the takeoff roll. However, he stated having adjusted the flap position for takeoff (10°), as instructed in the manual.

1.19. Additional information.

NIL.

1.20. Useful or effective investigation techniques.

NIL.

2. ANALYSIS.

The aircraft was taking off for a local air application flight. It would be the PIC's first takeoff with an AT-402A airplane from an airstrip for aeroagricultural use.

According to information collected, the pilot, on account of having extensive experience in agricultural operations, with around 10,000 hours of flight in EMB-201 aircraft, had been selected to join the staff of pilots of the AT-402A model.

Although being qualified, with valid ratings and CMA, he had little experience in the aircraft in question. The records logged in the aircraft logbook indicated that he had performed only 4 hours of training.

However, it was reported (without confirmation by means of pertinent records) that he had flown around 30 hours in the AT-402A model before the moment of the accident. All of his flights had departed from SSAK.

The pilot did not do a formal training course on the AT-402A model. He only completed familiarization and training, operating from the runway of the company's home base located in SSAK (*Carlos Ruhl Aerodrome, in Cruz Alta, State of Rio Grande do Sul*).

In this regard, only the aircraft models listed in the "Tables of Class-Aircraft Models Requiring Specific Endorsement" of the ANAC's Supplementary Instruction nº 61-006 - "Procedures for the Logging of Endorsements in Pilot Logbooks", would require training action and the respective registration of the endorsement provided for in the aforementioned IS before the start of effective operation, which was not the case with the AT-402A model.

On the day of the accident, the pilot flew the aircraft to the airstrip for aeroagricultural use of *Fazenda José Mezza*, where he landed uneventfully.

The PIC reported that, for takeoff, he adjusted the flaps to 10°, worked the required checks, and started an arrested takeoff, initially accelerating to 1,000 ft.lb and, after releasing the brakes, he increased acceleration to around 1,300 ft.lb.

In this respect, the AT-402A's AFM read, in its takeoff procedures, that for a takeoff with the hopper fully loaded and taking into account the torque and temperature limits, maximum power could be applied before the pilot released the brakes.

According to the PIC, the aircraft, upon arriving at the end of the runway, was still at a speed of approximately 60 kt, insufficient for takeoff and close to the stall speed of 55 kt referred in the table of Section 4 - Performance and Limitations, of the Air Tractor Pilot Training Course - Series 402, 502, 504, 602.

Realizing that the aircraft still did not have the necessary lift, the pilot applied more flap and pitched up the aircraft's nose, causing the PT-WVZ to float for a few meters, but not preventing the aircraft's right-hand wing from colliding with the ground.

Still in relation to speed, the constant performance diagram in the AT-402A's AFM established that, for a weight of 3,505 kg (7,727 lb.), the indicated speed to enable takeoff would be around 68 kt.

Additionally, the takeoff distance required for the airplane to overcome obstacle at 50 ft, for a weight of 3,175 kg (7,000 lb.), at an altitude of 1,360 ft, with a temperature of 24.3°C, with maximum takeoff power, on a hard and dry surface, would be approximately 900 m. However, the airstrip for aeroagricultural use, whose surface was grassy and soft, had dimensions of 700 x 16 m.

Relatively to the type of terrain, a note in the AFM read that the takeoff roll and acceleration would be impaired with operation on a grassy or soft runway surface.

As the airplane could not count on a runway length sufficient for takeoff, besides being at a speed below the minimum control speed (60 kt), its right-hand wing stalled and collided with the ground. The aircraft yawed and flipped, coming to rest in an upside down position. After the impact, there was fire, which consumed a large part of the aircraft. The pilot received first aid from the ground team.

Therefore, based on the evidence mentioned above and, considering that the pilot had little experience in the aircraft, and was making his first takeoff with the aircraft in question from an airstrip for aeroagricultural use, in a mission for the application of agricultural pesticides, one inferred that the training process previously received by the PIC was inefficient, on account of quantitative and/or qualitative deficiencies, as he was not given full knowledge and other technical conditions necessary for the conduction of the activity.

Similarly, inadequacies were identified in the work done by the pilot in preparation of the flight, since, during the takeoff attempt, the aircraft was operating with a weight considerably higher than the one allowed for the airstrip length available on *Fazenda José Mezza*.

In relation to managerial oversight, the company's SMM, in its item 1.3 - "Conditions for Operations at *Destaque Aviação Agrícola LTDA*.", read that, before each operation, the company's flight safety manager should evaluate the area of operation, in compliance with the provisions of letter b, section 137.301, Subpart D, of the RBAC-137:

- (b) The COA holder must perform a *GRSO* (SRM) prior to the start of operations at each location.

Therefore, controlling the risk inherent to landing at or taking off from a location not registered by ANAC would be essential for maintaining an acceptable level of safety performance.

In the case in question, the recommendable conduction of risk analysis and risk management would be able to identify that the location did not have the appropriate dimensions for the operation of the PT-WVZ in the flight that culminated in the accident.

The risk analysis was an assessment aimed at evaluating and weighing the risk indicators with the purpose of measuring dangerous situations in the operation based on their probability and severity, in a qualitative and/or quantitative fashion.

Finally, in this type of operation, cognitive functions, such as perception and decision-making, require high operational standards, which demand training for the development of technical capabilities and of the cognitive skills associated with them.

3. CONCLUSIONS.

3.1. Findings.

- a) The PIC held a valid CMA (Aeronautical Medical Certificate);
- b) the PIC held valid MNTE (Single-Engine Land Airplane) and PAGA (Agricultural Pilot - Airplane) ratings;
- c) the PIC had qualification, but little experience in the AT-402A airplane;

- d) the proof of the total flight hours and hours flown in the AT-402A airplane model reported by the PIC was not presented;
- e) the aircraft had a valid CVA (Airworthiness-Verification Certificate);
- f) the aircraft was above the weight limit specified by the manufacturer;
- g) the records of the airframe, engine, and propeller logbooks were not up to date;
- h) no evidence of failure or malfunction of the aircraft, or of its components, was reported;
- i) the meteorological conditions were suitable for the flight;
- j) the landing area for aeroagricultural use was approximately 700 m long, and had a height variation of approximately 11.5 m between the thresholds and the highest point of the terrain within the airstrip;
- k) the required takeoff distance would be approximately 900 meters, should the airplane be operating within the weight limits established by the manufacturer (7,000 lb.);
- l) the PIC did not do the AT-402A course given by the manufacturer, having only undergone adaptation and some local training sessions at the company's home base in SSAK;
- m) the AT-402A aircraft did not require specific endorsement for being operated, in accordance with the IS n° 61-006 in force on the date of the accident;
- n) no Safety Risk Management Manual was presented for the operation in progress, although the company had a Safety Management Manual approved by the ANAC;
- o) during the takeoff run, the aircraft failed to reach the minimum takeoff speed;
- p) after the aircraft overran the longitudinal limits of the airstrip, the right-hand wing collided with the ground, causing the aircraft to yaw and flip, stopping in an upside-down position in a direction opposite the one of departure, and catching fire;
- q) the aircraft was destroyed; and
- r) the PIC suffered minor injuries.

3.2. Contributing factors.

- Handling of aircraft flight controls – a contributor.

There was inadequacy in the pilot's handling of the aircraft's flight controls, as he tried to take off at a speed that was below the stall speed, and even extended the flap to a position not prescribed in the airplane's AFM for that phase of the flight.

- Instruction – a contributor.

There was inefficiency in the training process previously received by the PIC, due to quantitative and/or qualitative deficiencies, since full knowledge and other technical conditions required for carrying out the activity were not conferred to him.

Since the flight was planned for a takeoff above the maximum weight allowed, from a grass runway, with restricted dimensions and with a positive slope, one understands that an inadequate instruction process contributed to the crewmember not being fully aware of the operating limits and capabilities of the airplane.

- Perception – undetermined.

Possibly, on account of his little experience in AT-402A aircraft, there was a reduction in the PIC's situational awareness of the risks involved in operating above the prescribed

weight, in an airstrip for agricultural use with dimensions smaller than the ones he had operated in during his training.

- **Flight planning – a contributor.**

Inadequacies were identified in the work of preparation done by the pilot for the flight, since, during the takeoff attempt, the aircraft was operating with a weight above the limit for the model, and not consistent with the available airstrip length of *Fazenda José Mezza*.

- **Management planning – undetermined.**

The fact that the pilot did not do the AT-402A course taught by the manufacturer, just undergoing adaptation and some training sessions, operating from the company's home base, indicates a possible failure in the management planning process, since the company allocated a crewmember not duly qualified for the conduction of the operational activities.

- **Insufficient pilot's experience – undetermined.**

Despite being knowledgeable of the agricultural operation and having flying experience in EMB-201 aircraft, the crewmember did not fly more than the declared 30 flight hours in the AT-402A model. The aircraft logbook contained information that the PIC had flown around 4 hours and 20 minutes in the PT-WVZ.

- **Decision-making process – a contributor.**

On account of the pilot's reduced situational awareness, there were difficulties perceiving, analyzing, and choosing alternatives, as well as acting appropriately in relation to the attempt to take off with an aircraft above the takeoff weight established by the manufacturer in an area with restricted dimensions for the operation.

- **Managerial oversight – a contributor.**

Considering that the aircraft would take off with a weight exceeding the MTOW from an agricultural grassy runway with a positive slope, one understands that there was failure of supervision on the part of the management of the company operating the aircraft. The operator could and should have guaranteed that operational limits would be respected.

4. SAFETY RECOMMENDATIONS

A proposal of an accident investigation authority based on information derived from an investigation, made with the intention of preventing accidents or incidents and which in no case has the purpose of creating a presumption of blame or liability for an accident or incident.

In consonance with the Law n°7565/1986, recommendations are made solely for the benefit of safety, and shall be treated as established in the NSCA 3-13 "Protocols for the Investigation of Civil Aviation Aeronautical Occurrences conducted by the Brazilian State".

Brazil's National Civil Aviation Agency (ANAC) is recommended to:

A-021/CENIPA/2021 - 01

Issued on 02/20/2024

Work with *Destaque Aviação Agrícola Ltda.* - ME, so that that the referred operating company refines its flight planning and risk management mechanisms, aiming to increase the levels of competence and operational safety required for execution of the activities for which the company is certified.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On February 20th, 2024.

